

NASA TECH BRIEF



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Measurement of Gas Flow at Extremely Low Pressures

The problem:

Development of a method of accurate measurement of the flow of gases produced by evaporation or sublimation at pressures approaching total vacuum. Conventional gas-flow sensors depend on the gas's either turning of a rotor (whose speed is measured) or support of a ball in a vertical tapered tube (the height of the ball is measured). Both techniques are impractical at ultralow pressures.

The solution:

A new technique has been developed for water as the liquid undergoing change in phase, the problem being measurement of heat-rejection (in terms of flow of steam) for astronauts doing heavy work during extravehicular activity. The two-stage vacuum system used for simulation was capable of pumping at 2,600 ft³/min at a pressure of only a few microns of mercury. The technique gave measurements of heat-rejection on a realtime basis that were shown to be accurate within 1%.

At pressures close to zero, the rate of heat-removal caused by change in phase can be measured, as well

as flow of steam. The thermal performance or control of any heat-exchanger can be determined indirectly, and leakage of any foreign gas into a system can be compensated. The technique is applicable to many such liquids (or solids) as alcohols, mercury, petroleum derivatives, perfumes, and isotopes. This technique may interest the food-processing, beverage, and steam-power industries.

Note:

Documentation is available from:

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No patent action is contemplated by NASA.

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